

MOBILE ELECTRONIC APPARATUS, AND  
BATTERY PACK FOR THE APPARATUS

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BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to mobile electronic apparatus (e.g., internet appliances such as cell phones, mobile electronic information terminals, and Personal Digital Assistants (PDAs)) having an attachment part (battery pack, etc.) detachably attached to the electronic apparatus and also relates to a battery pack for the electronic apparatus.

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2. Description of the Related Art:

Multifunctional mobile electronic apparatus (various types of portable electronic information terminals and cell phones) nowadays not only function as electronic notepads or telephones but also receive/transmit electronic information and image information via wired/wireless networks. Further, such mobile electronic apparatus can also be used in bank account settlement, electronic commerce, or securities trading. For realizing these varying functions in one mobile electronic apparatus, various types of applications are started or executed in the

mobile electronic apparatus.

When such applications are started or executed in the mobile electronic apparatus, an ID and a password must be input for each application. Likewise, when bank  
5 account settlement or electronic commerce is made, a bank account number and a personal identification number (PIN) must be input.

In general, ID and bank account number are previously stored in a memory or the like so that the  
10 user is unnecessary to input such numbers by himself/herself, while the password and the PIN must be input by the user with push or touch buttons (ten keys) for verifying the user.

Further, mobile electronic information terminals,  
15 cell phones in particular, nowadays serve as phone books and communicators for sending and receiving electronic-mail messages. In conventional apparatus, phone-book data or electronic-mail messages are input by the user with push or touch buttons (ten keys). As  
20 provided originally for the purpose of inputting telephone numbers, such touch buttons are inconvenient in use for inputting letters or characters because some troublesome procedures, namely, pressing the same key several times, are required.

25 As described above, user verification is carried out by inputting passwords or personal identification numbers (PINs) in the conventional mobile electronic

apparatus. Yet many of users tend to use a string of characters or digits that are relevant to their personal peripheral data (for example, the user's or family member's name or birthday, telephone number, favorite word, etc.) as a password or a PIN. Assuming that a mobile electronic apparatus with such passwords or PINs registered is stolen or lost, it is a danger that an unauthorized person might use the apparatus in an evil purpose. Therefore a mobile electronic apparatus with increased security has been cherished.

To resolve this problem, user verification with use of biometric information such as a fingerprint has ever been tarried. As a practical matter, however, it is difficult to introduce such user verification function utilizing biometric information into a huge number of existing mobile electronic apparatus already been widely spread. For instance, if biometric user verification is performed in plural systems, devices and software corresponding to individual types of operation systems are required. In view of cost, however, it would be difficult to provide such devices and software to all those systems.

Despite of the great convenience realized by the function of bank account settlement, electronic commerce, or stock trade equipped in the convention mobile electronic apparatus, there remains a serious problem of poor security. Moreover, because of poor

extendability of mobile information terminals, cell phones in particular, it is difficult to add any form of user verification function afterward. Accordingly, in order to realize biometric verification in a mobile  
5 electronic apparatus, not an add-on to the mobile electronic apparatus but an independent device for user verification that works in association with the mobile electronic apparatus has been cherished.

Furthermore, in the conventional mobile  
10 electronic apparatus, cell phones in particular, because of the use of touch buttons (ten keys), which are originally provided to be used in inputting telephone numbers, in inputting letters or characters, troublesome procedures are necessitated thereby  
15 requiring a long time. So, further expansion of the I/O function has long been desired.

For this, there has been longed for an easy way of expansion of the I/O function in existing mobile electronic apparatus, making the apparatus more  
20 user-friendly. It is also desired to provide the user verification function of great importance to the existing mobile electronic apparatus in a simple way.

When introducing an additional function into the mobile electronic apparatus such as cell phones and  
25 mobile electronic information terminals, an additional apparatus to execute the additional function tends to be connected to the mobile electronic apparatus via a

cable so that the use of the mobile electronic information terminal is limited to desktop use despite of its name "mobile".

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#### SUMMARY OF THE INVENTION

With the foregoing problems in view, one object of the present invention is to provide a mobile electronic apparatus in which various functions can be added and expanded in a simple manner, without impairing the mobility of the mobile electronic apparatus and without making any change in hardware of a mobile electronic apparatus currently being put on the market, thus improving the user friendliness.

Another object of the invention is to provide a battery pack for the above-mentioned mobile electronic apparatus.

In order to accomplish the above object, according to the present invention, there is provided a mobile electronic apparatus having the following generic features (1) through (6):

(1) the mobile electronic apparatus comprises: a main body; an attachment part detachably attached to the main body for performing a predetermined function when attached to the main body, which attachment part has an input/output section integrally formed with the attachment part for inputting/outputting information

(data); and an interface section for transferring input/output signals relating to the last-named information (data) between the main body and the attachment part.

5           (2) The attachment part may be a battery pack having an input section integrally formed with the battery pack for inputting information (data), which battery pack is detachably attached to the main body for transmitting the input signal input from the input  
10 section to the main body via a power supply terminal. As a preferred feature, the battery pack may include a signal synthesizing circuit for carrying the input signals, which are input by the input section, onto a power supply voltage to be supplied from the battery  
15 pack to the main body, and the main body may include a signal separating circuit for separating and picking up the input signals carried on the power supply voltage. As a further preferred feature, the main body may have a converting section for converting the input signals,  
20 which are separated and picked up by the signal separating circuit, into key-input-pattern signals.

          (3) The mobile electronic apparatus comprises: the main body; an attachment part detachably attached to the main body for performing a predetermined function  
25 when attached to the main body; an input section, formed integrally with the attachment part, for measuring biometric information of an object person to be verified

and inputting the measured biometric information; an extracting section, which is formed integrally with the attachment part and operatively connected with the input section, for extracting biometric feature information  
5 from the biometric information, which is measured and input by the input section, for verification of the object person; and an interface section, disposed between the main body and the attachment part, for sending the biometric feature information from the  
10 extracting section to the main body.

(4) The mobile electronic apparatus comprises: a main body; an attachment part detachably attached to the main body for performing a predetermined function when attached to the main body; the above-mentioned  
15 input section and extracting section formed integrally with the attachment part; a comparing/verifying section, formed integrally with the attachment part and operatively connected with the extracting section, for verifying the object person by comparing the biometric  
20 feature information extracted by the extracting section with reference biometric feature information about the authorized user which information is previously obtained; and an interface section, disposed between the main body and the attachment part, for sending the  
25 result of verification by the comparing/verifying section to the main body.

(5) The mobile electronic apparatus comprises:

a main body; an attachment part detachably attached to the main body for performing a predetermined function when attached to the main body; the above-mentioned input section, extracting section, and

5 comparing/verifying section, formed integrally with the attachment part; a storage section, formed integrally with the attachment part, for storing personal data of the authorized person; a personal data read-out section, formed integrally with the attachment

10 part and operatively connected with the storage section and the comparing/verifying section, for reading out the personal data from the storage section when the biometric feature information of the object person is identical with the reference biometric feature

15 information of the authorized user as the result of verification by the comparing/verifying section; and an interface section, disposed between the main body and the attachment part, for sending to the main body the personal data, which is read out from the storage

20 section by the personal data read-out section.

(6) The attachment part may be a battery pack equipped with the above-mentioned input section, extracting section, comparing/verifying section, storage section, personal data read-out section, and

25 also a signal synthesizing circuit for carrying the personal data, which is read out by the personal data read-out section, onto a supply power voltage from the



battery pack to the main body, which battery pack is detachably attached to the main body of the mobile electronic apparatus. And the main body includes: a signal separating circuit for separating the voltage  
5 signal carried on the supply power voltage to pick up the personal data; and a converting section for converting the personal data, which is separated and picked up by the signal separating section, into a key-input-pattern signal.

10 Further, a battery pack for the mobile electronic apparatus, according to the present invention, has the following generic features (7) through (11):

(7) the battery pack is adapted to be detachably attached to a main body of a mobile electronic apparatus  
15 which is able to be carried by an authorized user for performing various electronic information processes. The battery pack comprises: a casing adapted to be attached to the main body of the mobile electronic apparatus; a battery received in the casing; an  
20 input/output section, formed integrally with the casing, for inputting/outputting information (data); and an interface section, formed integrally with said casing, for transferring input/output signals relating to the last-named information (data) between the input/output  
25 section and the main body when the casing is attached to the main body. In this instance, the interface section may further include a signal synthesizing

circuit, formed integrally with the casing and  
operatively connected with the battery, for carrying  
the input signals, which are input by the input/output  
section, onto a power supply voltage to be supplied from  
5 the battery pack to the main body.

(8) The battery pack has the input section, the  
extracting section, and the interface section,  
described above in (3), which sections are integrally  
formed with the casing of the mobile electronic  
10 apparatus.

(9) The battery pack has the input section, the  
extracting section, the verifying/comparing section,  
and the interface section, described above in (4), which  
sections are integrally formed with the casing of the  
15 mobile electronic apparatus.

(10) The battery pack has the input section, the  
extracting section, the verifying/comparing section,  
the storage section, the personal data read-out section,  
and the interface section, described above in (5), which  
20 sections are integrally formed with the casing of the  
mobile electronic apparatus.

(11) The battery pack has the input section, the  
extracting section, the verifying/comparing section,  
the storage section, the personal data read-out section,  
and the signal synthesizing circuit, described above  
25 in (6), which sections are integrally formed with the  
casing of the mobile electronic apparatus.

Accordingly, partly since the mobile electronic apparatus of the present invention has the input/output section (keyboard, etc.) for inputting/outputting information (data), formed integrally with the attachment part (replacement part/function part), which is detachably attached to the main body of the apparatus, and partly since input/output signals relating to the data are transferred between the input/output section and the main body through the interface section (for example, an optical communications section, a radio communications section, a connector, an electric contact, and a cable), it is possible to add various types of additional input/output (I/O) functions to an existing mobile electronic apparatus merely by replacing an existing attachment part (replacement part/function part) with an attachment part of the present invention, without the risk of impairing the mobility of the mobile electronic apparatus and without making any modification to hardware, thus resulting in the improved user friendliness.

Moreover, in the mobile electronic apparatus of the present invention, when adding and extending a new I/O function to the apparatus, an input/output section for realizing the additional function can be detachably attached to the main body in an extremely ease way. And also, since the battery pack, which is attached to the

main body, has the input/output section integrally formed therewith, it is easy to arrange the interface section between the input/output section and the main body.

5 Further, partly since the input/output section (keyboard, etc.) for inputting/outputting information (data) is formed integrally with the battery pack to share the battery pack with the main body, and partly since the input signal is transmitted via a power supply  
10 terminal (DC terminal) for the battery pack, it is possible to add various types of additional input/output (I/O) functions to an existing mobile electronic apparatus merely by replacing an existing battery pack with the battery pack having the input section of the  
15 present invention, without the risk of impairing the mobility of the mobile electronic apparatus and without making any modification to hardware, thus resulting in the improved user friendliness.

In this instance, when adding and extending a new  
20 I/O function to the apparatus, the input/output section for realizing the additional function can be detachably attached to the main body in an extremely ease way due to the input section that is formed integrally with the battery pack.

25 Furthermore, since the input signal from the input section is carried onto a power supply voltage by the signal synthesizing circuit, and is then, on the main

body side, separated and picked up from the voltage by the signal separating circuit, the power supply terminal for the battery pack can serve as both a power supply and an interface at the same time, thus making it possible to transmit the input signal from the input section to the main body without using any newly equipped construction. Accordingly, it is resultantly possible to send the input signal from the input section, which serves as a keyboard, camera, tablet, user verifying device, or the like, to the main body, without the need for an interface newly equipped in hardware, or without making any change in the design of the existing mobile electronic apparatus.

Still further, since the input signal, which is separated by the signal separating circuit, is converted by the converting section into a key-input-pattern signal treated in the main body, it is possible to keep the compatibility between the signal from the input section and the signal input through a keyboard originally equipped to the main body, thereby making it possible to treat these signals without discrimination.

In the meantime, the following processes are performed on the battery pack side of the present invention. The input section measures and inputs biometric feature information of an object person to be verified, from which measured and input biometric

information the extracting section extracts biometric feature information for verifying the object person. The extracted biometric feature information for user verification is then sent from the battery pack to the  
5 main body side via the interface section, thereby enabling the main body to use the thus obtained biometric feature information for user verification.

Therefore, since the biometric user verification can be easily associated with the mobile electronic apparatus merely by replacing an existing battery pack  
10 with the battery pack of the present invention having the input section, the extracting section, and the interface section, without the risk of impairing the mobility of the mobile electronic apparatus and without making any modification to hardware, it is possible to  
15 most easily add to the conventional mobile electronic apparatus a user verification function that effectively performs various types of verification processes, which have nowadays been introduced into the conventional  
20 mobile electronic apparatus, thereby improving the user friendliness.

And further, the following processes are performed on the battery pack side of the present invention. The input section measures and inputs biometric feature  
25 information of an object person to be verified, from which measured and input biometric information the extracting section extracts biometric feature

information for verifying the object person. After that, still on the battery pack side, the comparing/verifying section compares/verifies the extracted biometric feature information of the object person with reference biometric feature information, and the result of the comparing/verifying is then sent from the battery pack to the main body via the interface section, thereby enabling the main body to execute a corresponding process in response to the result of the verification.

Therefore, since the biometric user verification can be easily associated with the mobile electronic apparatus merely by replacing the existing battery pack with the battery pack of the present invention having the input section, the extracting section, the comparing/verifying section, and the interface section, without the risk of impairing the mobility of the mobile electronic apparatus and without making any modification to hardware, it is possible to provide the conventional mobile electronic apparatus with a user verification function in which various types of verification processes having nowadays been introduced into the conventional mobile electronic apparatus will be effectively performed, thereby improving the user friendliness.

Furthermore, the following processes are performed on the battery pack side of the present

invention. Using the input section, the extracting section, and the comparing/verifying section, if it is recognized that the biometric feature information of the object person is identical with the reference  
5 biometric feature information of the authorized user, the personal data read-out section reads out the personal data from the storage section. The thus read-out personal data is then sent from the battery pack to the main body via the interface section. With  
10 this construction, it is possible to provide the mobile electronic apparatus and the battery pack with the function of storing and managing the personal data of the authorized user by using biometric information.

In other words, it is possible to protect or guard  
15 the authorized user's personal data stored in the mobile electronic apparatus by using biometric information, which is free of being stolen or faked. For example, the user must be verified using fingerprint information before sending the personal data to the main body,  
20 thereby an access to the personal data is permitted in the main body, thus guaranteeing a highest degree of security.

Therefore, it is possible with ease to associate the storage section protected by the biometric user  
25 verification with the mobile electronic apparatus merely by replacing an existing battery pack with the battery pack of the present invention having the input



section, the extracting section, the  
comparing/verifying section, the storage section, the  
personal data read-out section, and the interface  
section, without the risk of impairing the mobility of  
5 the mobile electronic apparatus and without making any  
modification to hardware, thereby improving the user  
friendliness.

And still further, the following processes are  
performed on the battery pack side of the present  
10 invention. If it is recognized that the biometric  
feature information of the object person is identical  
with the reference biometric feature information of the  
authorized user by using the input section, the  
extracting section, and the comparing/verifying  
15 section, the personal data read-out section reads out  
the personal data from the storage section. After that,  
still on the battery pack side, the read-out personal  
data is carried by the signal synthesizing circuit onto  
a power supply voltage as a voltage signal to be sent  
20 from the battery pack to the main body. On the main  
body side, the signal separating circuit separates and  
picks up the personal data from the power supply voltage  
and the converting section converts the separated data  
into a key-input-pattern signal for the main body. With  
25 this construction, it is possible to provide the mobile  
electronic apparatus and the battery pack with a  
function of protecting or guarding the authorized user's

personal data stored in the mobile electronic apparatus by using biometric information.

In other words, it is possible to protect or guard the authorized user's personal data stored in the mobile electronic apparatus by using biometric information, which is free of being stolen or faked. For example, the user must be verified using fingerprint information before sending the personal data to the main body, whereupon an access to the personal data is permitted in the main body, thus guaranteeing a highest degree of security.

Therefore, it is possible with ease to associate the storage section protected by the biometric user verification with the mobile electronic apparatus merely by replacing an existing battery pack with the battery pack of the present invention having the input section, the extracting section, the comparing/verifying section, the storage section, the personal data read-out section, and the signal synthesizing circuit, without the risk of impairing the mobility of the mobile electronic apparatus and without making any modification to hardware, thus improving the user friendliness.

At that time, since the personal data is carried onto a power supply voltage by the signal synthesizing circuit, and is then, on the main body side, separated and picked up from the voltage by the signal separating

circuit, the power supply terminal for the battery pack can serve as both a power supply and an interface at the same time, thus making it possible to transmit the personal data from the input section to the main body with no need for any arrangement made in the construction. Accordingly, it is resultantly possible to add and extend an additional function to the existing mobile electronic apparatus, without the need for an interface to be newly equipped in hardware, or without making any change in the design of the apparatus.

Further, since the personal data, which is separated by the signal separating circuit, is converted by the converting section into a key-input-pattern signal treated in the main body, it is possible to keep the compatibility between the personal data and the signal input through a keyboard originally equipped to the main body, thereby making it possible to treat these signals without discrimination.

As a preferred feature, the battery pack may have the memory section storing previously obtained reference biometric feature information. With this construction, it is possible to discriminate whether or not the object person is the authorized user, whose reference biometric feature information is stored in the memory section.

As another preferred feature, the attachment part/battery pack (replacement part) may have a medium

interface section adapted to be operatively connected with a portable memory medium (IC card, etc.) which stores previously obtained reference biometric feature information and also has a feature information read-out section for reading out the reference biometric feature information from the portable memory medium through the medium interface section. With this construction, it is possible to discriminate whether or not the object person is the authorized user, whose reference biometric feature information is stored in the portable memory medium.

As still another preferred feature, the attachment part/battery pack (replacement part) may have a communications section for receiving the reference biometric feature information from an external apparatus. With this construction, it is possible to discriminate whether or not the object person is the authorized user, whose reference biometric feature information is given from the external apparatus.

As a further preferred feature, a battery may be replaceable with another one. With this construction, even when the battery itself becomes wearing out, the user can continue to use the battery pack having a new function by only replacing the battery with another.

Other objects and further features of the present invention will be apparent from the following detailed description when read in conjunction with the

accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5        FIG. 1 is a block diagram schematically showing  
a mobile electronic apparatus of a first embodiment of  
the present invention;

FIG. 2 is a block diagram schematically showing  
the mobile electronic apparatus of a second embodiment;

10       FIG. 3 is a block diagram schematically showing  
the mobile electronic apparatus of a third embodiment;

FIG. 4 is a circuit diagram showing a signal  
synthesizing circuit (adder circuit) according to the  
third embodiment;

15       FIG. 5 is a circuit diagram showing a signal  
separating circuit (subtractor circuit) according to  
the third embodiment;

FIG. 6 is a block diagram schematically showing  
the mobile electronic apparatus of a fourth embodiment;

20       FIGS. 7 and 8 are diagrams respectively  
illustrating an interface section according to the  
fourth embodiment;

FIG. 9 is a block diagram schematically showing  
the mobile electronic apparatus of a first modification  
25 (a first modification of the interface section) of the  
fourth embodiment;

FIG. 10 is a block diagram schematically showing

the mobile electronic apparatus of a second modification  
(a second modification of the interface section) of the  
fourth embodiment;

FIG. 11 is a block diagram schematically showing  
5 the mobile electronic apparatus of a third modification  
(a third modification of the interface section) of the  
fourth embodiment;

FIG. 12 is a block diagram schematically showing  
the mobile electronic apparatus of a fourth modification  
10 of the fourth embodiment;

FIG. 13 is a block diagram schematically showing  
a first example of a user verifying section of the fourth  
embodiment;

FIG. 14 is a block diagram schematically showing  
15 a second example of the user verifying section of the  
fourth embodiment;

FIG. 15 is a block diagram schematically showing  
a first modified form of the second example of the user  
verifying section of the fourth embodiment;

FIG. 16 is a block diagram schematically showing  
20 a second modified form of the second example of the user  
verifying section of the fourth embodiment;

FIG. 17 is a block diagram schematically showing  
a third example of the user verifying section of the  
25 fourth embodiment; and

FIG. 18 is a block diagram schematically showing  
the mobile electronic apparatus of a fifth modification

of the fourth embodiment.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

5           Various preferred embodiments of the present invention will now be described in detail below with reference made to relevant accompanying drawings.

(1) First Embodiment:

FIG. 1 shows a mobile electronic apparatus of a  
10 first embodiment. The mobile electronic apparatus 10A of the first embodiment, which is carried by an authorized user to perform various processes to various types of electronic information, has a battery power supply casing (battery pack) 10b, which is detachably  
15 attached to a main body 10a of the apparatus 10A (part for performing a predetermined function). To cite examples in the market, there are internet appliances such as cell phones, mobile electronic information terminals, and Personal Digital Assistants (PDAs). In  
20 this instance, the main body 10a comprises a CPU, ROM, RAM, LCD, and keys (push/press buttons) (not shown in the drawing), which are interconnected by a bus line.

The power supply casing (hereinafter, also called battery pack) 10b has a battery 10c lodged therein for  
25 supplying electric power to the above-mentioned devices, which are equipped in the main body 10a. The electric power of the battery 10c is fed from the battery pack

10b side to the main body 10a side via a power supply terminal 13. And, in the first embodiment, the battery 10c is detachable from the battery pack 10b.

The battery pack 10b has an extended I/O device  
5 section (input/output section) 30 formed integrally with the battery pack 10b. The extended I/O device section 30 inputs/outputs various data (information) to/from the mobile electronic apparatus 10A and is provided for expanding the I/O function originally given  
10 to the main body 10a, or for adding additional I/O functions.

Concretely, the followings are examples of the extended I/O device section 30: a keyboard (third embodiment (FIG. 3)), pen tablet, display device (LCD),  
15 image-taking device (camera), disk drive, memory device (second embodiment (FIG. 2)), network device, and a user verifying section (fourth embodiment (FIGS. 6 through 18)).

The battery pack 10b also has a data communications  
20 section 11, which sends data input from the extended I/O device section 30 to the main body 10a, and which receives data from the main body 10a and then inputs the received data to the extended I/O device section 30.

25 At that time, electric power is supplied from the battery 10c to the data communications section 11 and to the extended I/O device section 30. In other words,



in the first embodiment, the data communications section 11 and the extended I/O device section 30 shares the battery 10c as a common power source with the main body 10a.

5           The main body 10a also has a data communications section 12, which receives data from the battery pack 10b (extended I/O device section 30, data communications section 11) and then sends the received data to the CPU or the RAM (not shown).

10           And, an interface (I/F) section 20, which is disposed between the main body 10a and the battery supply casing 10b, transfers input/output signals (data communications) between the extended I/O device section 30 (data communications section 11) and the main body  
15 10a (data communications section 12).

          In use, the followings are examples of the interface section 20: an optical communications section (reference number 21 of FIGS. 2, 7, 8), which receives/sends optical signals as the input/output  
20 signals; a radio communications section (reference number 22a, 22b of FIG. 9), which sends/receives radio signals as the input/output signals; a connector or an electric contact (reference number 23 of FIG. 10), which is connected between the battery pack 10b and the main  
25 body 10a; and a cable (not shown) connecting the extended I/O device section 30 (data communications section 11) and a connector terminal (not shown) of the main body

10a.

When extending an I/O function of the mobile electronic information terminal, an additional external apparatus having a new I/O function is normally  
5 connected to the mobile electronic information apparatus via a cable so that the use of the mobile electronic information apparatus is limited to desktop use despite of its name "mobile".

In an ordinary mobile electronic apparatus such  
10 as a cell phone, a battery pack, which is detachably mounted to the cell phone, is replaced by another when it becomes wearing out (for example, when the workable time of the battery is very short even after fully recharged).

15 In the mobile electronic apparatus 10A of the first embodiment (also in the mobile electronic apparatus 10B, 10C, 10D, 10D-1 through 10D-5 of the embodiments described later), the extended I/O device section 30 for realizing a new I/O function or extending the present  
20 input/output function of the main body 10a, is formed integrally with the battery pack 10b, which is detachably attached to the main body 10a, thereby making the extended I/O device section 30 also attached to the main body 10a.

25 At this state, data communication is performed between the extended I/O device section 30 and the main body 10a via the interface section 20.

Therefore, it is possible to add and extend various types of user-expected I/O functions to an existing mobile electronic apparatus in a simple manner, namely, only by replacing an existing battery pack, which is  
5 detachably attached, with another battery pack 10b to which the extended I/O device section 30 for realizing the expected I/O function is equipped, without the risk of impairing the mobility of the mobile electronic apparatus 10A and without making any modification to  
10 hardware of the main body 10a of the mobile electronic apparatus 10A, thus improving the user friendliness in a great degree.

Further, the extended I/O device section 30 formed integrally with the battery pack 10b, which is attached  
15 to the main body 10a, also facilitates the preparation of the interface section 20 between the extended I/O device section 30 and the main body 10a.

Furthermore, since the battery 10c is shared as a power source among the data communications section  
20 11, the extended I/O device section 30, and the main body 10a, it is unnecessary to prepare another power supply dedicated for the extended I/O device section 30.

Still further, since only the battery 10c is  
25 detachable from the battery pack 10b, the user can continue to use the battery pack having the extended I/O function by only replacing the battery 10c with

another even when the battery itself becomes wearing out.

(2) Second Embodiment:

FIG. 2 shows a mobile electronic apparatus of a second embodiment. The mobile electronic apparatus 10B of the second embodiment, which is also carried by an authorized user to perform various processes to various types of electronic information, has a battery power supply casing (battery pack) 10b, which is detachably attached to a main body 10a of the apparatus 10B. To cite examples in the market, there are internet appliances such as cell phones, mobile electronic information terminals, and PDAs. Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted here.

In the mobile electronic apparatus 10B of the second embodiment, however, a small-sized hard disk section 31 is built in the battery pack 10b as a integral part to serve as the extended I/O device section 30 of the first embodiment, and an optical communications module (optical communications section) 21 is equipped to serve as the interface section 20 of the first embodiment.

The optical communications module 21, which is formed in such a manner as described later with reference made to FIG. 8 in the fourth embodiment, is disposed

where the battery pack 10b contacts with the main body 10a of the mobile electronic apparatus 10B and receives/sends I/O signals from/to the hard disk section 31 in the form of optical signals such as infrared rays.

5 Via this optical communications module 21 (and the data communications sections 11, 12), desired data is written from the main body 10a side to the hard disk section 31 while the data stored in the hard disk section 31 is readout to the main body 10a.

10 With this construction, in the mobile electronic apparatus 10B, the hard disk section 31 is formed integrally with the battery pack 10b, which is detachably attached to the main body 10a, thereby making the hard disk section 31 also attached to the main body  
15 10a.

At this state, data communication is performed between the hard disk section 31 and the main body 10a via the optical communications module 21.

Therefore, it is possible to add and expand the  
20 amount of the memory of an existing mobile electronic apparatus in a simple manner, namely, only by replacing an existing battery pack, which is detachably attached, with another battery pack 10b having the hard disk 31, without the risk of impairing the mobility of the mobile  
25 electronic apparatus 10B and without making any modification to hardware of the main body 10a of the mobile electronic apparatus 10B, thus improving the user

friendliness in a great degree. And also, in the second embodiment, since the optical communications module 21 is employed as the interface, it would be made easy to use a camera or a display likely to be provided to the battery pack 10b as an integral part.

Additionally, since the battery 10c is shared as a common power source among the data communications section 11, the hard disk section 31, and the main body 10a, it is unnecessary to prepare another power supply dedicated for the hard disk section 31.

Still further, since only the battery 10c is detachable from the battery pack 10b, the user can continue to use the battery pack 10b having the hard disk section 31 by only replacing the battery 10c with another even when the battery 10c itself becomes wearing out.

### (3) Third Embodiment:

FIG. 3 shows a mobile electronic apparatus of a third embodiment; FIG. 4 shows the details of a signal synthesizing circuit (adder circuit) of this embodiment; and FIG. 5 shows the details of a signal separating circuit (subtractor circuit) of this embodiment. Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted here.

The mobile electronic apparatus 10C of the third embodiment, which is also carried by an authorized user

to perform various processes to various types of electronic information, has a battery power supply casing (battery pack) 10b, which is detachably attached to a main body 10a of the apparatus 10C. To cite examples  
5 in the market, there are cell phones and mobile electronic information terminals. The main body 10a of the mobile electronic apparatus 10C has keys such as push/press buttons (not shown), a signal (keyboard signal) input through which keys is input to the keyboard  
10 signal input section 70 in a predetermined form.

In the mobile electronic apparatus 10C of the third embodiment, however, an extended keyboard section (input section) 32 is mounted to the battery pack 10b as an integral part to serve as the extended I/O device  
15 section 30 of the first embodiment, and a signal synthesizing circuit 40, a signal separating circuit 50, a data converting section 60, and a keyboard signal input section 70 are equipped in place of the data communications sections 11, 12 and the interface section  
20 20 of the first embodiment.

A key-input signal input from the extended keyboard section 32 is sent to the main body 10a via a power supply terminal (DC terminal) 13, which is electrically connected between the battery pack 10b and  
25 the main body 10a for supplying electric power from the battery 10c to the main body 10a.

For this purpose, the signal synthesizing circuit

40 is equipped to the battery pack 10b while the signal separating circuit 50, the data converting section 60, and the keyboard signal input section 70 are equipped to the main body 10a.

5       The signal synthesizing circuit 40 carries the key-input signal (output data signal, signal pulse), which is input from the extended keyboard section 32, onto a power supply voltage (output voltage), which is fed from the battery 10c to the main body 10a, in the  
10 form of a frequency modulation (FM) signal or an amplitude modulation (AM) signal. FIG. 4 shows an exemplary signal synthesizing circuit 40, which is formed as an adder circuit (for adding the key-input signal and the power supply voltage) constituted by two  
15 operational amplifiers 41, 42 having a variable resistor circuit (VR). After being synthesized with the key-input signal by the signal synthesizing circuit 40, the power supply voltage is fed to the main body 10a via the power supply terminal 13 as normal, thereby  
20 sending the key-input signal from the battery pack 10b to the main body 10a.

      The signal separating circuit 50 separates the key-input signal from the thus obtained synthesized signal (power supply voltage) received from the battery  
25 pack 10b. That is, the signal separating circuit 50 separates a key-input signal component and a power supply component. FIG. 5 shows an exemplary signal



separating circuit 50, which is formed as an subtracter circuit (for subtracting a normal power supply voltage, which is separately sent, from the synthesized signal obtained by synthesizing the key-input signal and the power supply voltage) constituted by two operational  
5 amplifiers 51, 52 having a variable resistor circuit (VR).

The data converting section 60 converts the form of the key-input signal, which is separated by the signal  
10 separating circuit 50, into the same form as that of a key-input signal input to the main body 10a (keyboard signal of the main body 10a side) and inputs the resultant signal to the keyboard signal input section 70.

With this construction, in the mobile electronic  
15 apparatus 10C, the extended keyboard section 32 is formed integrally with the battery pack 10b, which is detachably attached to the main body 10a, thereby making the extended keyboard section 32 also attached to the main body 10a.

At this state, the key-input signal, which is input  
20 from the extended keyboard section 32, is carried onto the output voltage, which is fed from the battery 10c, in the form of a frequency modulation (FM) signal or an amplitude modulation (AM) signal to produce the  
25 synthesized signal. The synthesized signal is then sent to the main body 10a via the power supply terminal 13. On the main body 10a, the signal separating circuit

50 separates the synthesized signal received from the battery pack 10b into a power supply component and an input data signal component.

After that, the separated input data signal component, or the output signal from the extended keyboard section 32, is converted into a key-input-pattern signal (keyboard signal) of a predetermined form before input to the keyboard signal input section 70.

10 In this manner, since it is possible to keep the compatibility between the output signal (key-input signal) from the extended keyboard section 32 and the input data signal input through the keys (push/press buttons) of the main body 10a, the output of the extended keyboard section 32 can be input to the keyboard signal input section 70 without being discriminated from the above-mentioned keyboard signal input through the keys.

Therefore, it is possible to greatly expand the key-input function originally equipped to the main body 10a in a simple manner, namely, only by replacing the existing battery pack, which is detachably attached to the main body 10a of the mobile electronic apparatus 10C, with another battery pack 10b to which the extended keyboard section 32 is equipped, without the risk of impairing the mobility of the mobile electronic apparatus 10C and without making any modification to hardware of the main body 10a of the mobile electronic

apparatus 10C, thus providing significantly improved user friendliness.

Further, since the input signal from the extended keyboard section 32 is carried onto a power supply voltage by the signal synthesizing circuit 40, and is then, on the main body 10a side, separated and picked up from the voltage by the signal separating circuit 50, the power supply terminal 13 for the battery pack 10b can serve both as a power supply and as an interface at the same time, thus making it possible to send the key-input signal from the extended keyboard section 32 to the main body 10a without making any arrangement in the construction. Accordingly, it is resultantly possible to send the input signal from the extended keyboard section 32 to the main body 10a, without the need for an interface newly equipped in hardware, or without making any change in the design of the existing mobile electronic apparatus.

Furthermore, also in the third embodiment, since only the battery 10c is detachable from the battery pack 10b, the user can continue to use the battery pack having the extended keyboard section 32 by only replacing the battery 10c with another even when the battery itself becomes wearing out.

In the above description of the third embodiment, the input section mounted to the battery pack 10b was exemplified by the extended keyboard section 32.

Alternatively, the input section may be a camera, a table, or a user verifying device. In that case also, the signal is sent to the main body 10a via the power supply terminal 13, and like results and effects to those of the third embodiment can be achieved. A description will be made later in the fourth embodiment with reference to FIGS. 11 and 18, of an example in which the input section is the user verifying device and in which the signal output from the user verifying device is sent to the main body 10a via the power supply terminal 13.

(4) Fourth Embodiment:

FIG. 6 shows a mobile electronic apparatus of a fourth embodiment. The mobile electronic apparatus 10D of the fourth embodiment, which is also carried by an authorized user to perform various processes to various types of electronic information, has a battery power supply casing (battery pack) 10b, which is detachably attached to a main body 10a of the apparatus 10D. To cite examples in the market, there are cell phones and mobile electronic information terminals. Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted here.

In the mobile electronic apparatus 10D of the fourth embodiment, however, a user verifying section 100 is built in the battery pack 10b as an integral part to serve as the extended I/O device section 30 of the

first embodiment. The user verifying section 100 verifies an object person by using biometric information (fingerprint, palmprint, finger shape, hand shape, voiceprint, retina, iris, facial recognition, signature dynamics, blood vessel pattern, key strokes, etc.) and outputs corresponding information in response to the verifying result. The data output from the user verifying section 100 is then sent from the battery pack 10b side to the main body 10a via the interface section 20 (and the data communications sections 11, 12).

Precisely, the user verifying section 100 is constructed in such a manner as described later with reference made to FIGS. 13 through 18 (reference numbers 100A, 100B, 100B-1, 100B-2, 100C).

15 An exemplary interface section 20 of the fourth embodiment will be described later with reference made to FIGS. 7 through 11.

Further, when a fingerprint is used as the biometric information to verify a user, the following data is sent from the user verifying section 100 to the main body 10a:

- 20 a) fingerprint feature information for verification extracted from the fingerprint information (described later with reference to FIG. 13);
- 25 b) fingerprint verification result data (described later with reference to FIGS. 14 through 16);
- c) personal data (personal identification code

(PIC) and account, etc.) readout in response to the fingerprint verification result (described later with reference to FIG. 17).

With this construction, in the mobile electronic apparatus 10D, the user verifying section 100 is formed integrally with the battery pack 10b, which is detachably attached to the main body 10a, thereby making the user verifying section 100 also attached to the main body 10a.

At this state, the verification result data output from the user verifying section 100 is sent from the battery pack 10b to the main body 10a via the interface section 20.

Therefore, it is possible to associate the user verification function utilizing biometric information (fingerprint) with the mobile electronic apparatus 10D in a simple manner, namely, only by replacing the existing battery pack, which is detachably attached to the main body 10a of the existing mobile electronic apparatus 10D, with another battery pack 10b to which the user verifying section 100 is equipped, without the risk of impairing the mobility of the mobile electronic apparatus 10D and without making any modification to hardware of the main body 10a of the mobile electronic apparatus 10D. Thereby, it is possible to most easily add to the mobile electronic apparatus 10D the user verification function that effectively realizes

various types of verification processes, which have nowadays been introduced in conventional mobile electronic apparatus, thus improving the user friendliness.

5 Further, also in the fourth embodiment, since the battery 10c is shared as a common power source among the data communications section 11, the user verifying section 100, and the main body 10a, it is unnecessary to prepare another power supply dedicated for the user  
10 verifying section 100.

Still further, since only the battery 10c is detachable from the battery pack 10b, the user can continue to use the battery pack 10b having the user verifying section 100 by only replacing the battery 10c  
15 with another even when the battery itself becomes wearing out.

#### (4-1) Interface Section:

FIGS. 7 and 8 show respectively an interface section of the fourth embodiment. In these examples,  
20 the optical communications module (optical communications section) 21 the same as that of the second embodiment is provided as the interface section.

The optical communications module 21, which is disposed where the battery pack 10b and the main body  
25 10a contact, transfers optical signals (IrDA), such as infrared rays, between the battery pack 10b and the main body 10a. Data output from the user verifying section

100 is sent from the battery pack 10b to the main body 10a via the optical communications module 21 (and the data communications sections 11, 12) in the fourth embodiment.

5           In the optical communications module 21, as shown in FIG. 8, a light emitting module (LED for optical communications) 21a and a light receiving module (photo acceptance element) 21b are provided in pairs to the battery pack 10b and the main body 10a, respectively,  
10           in order to send the data from the battery pack 10b to the main body 10a in the form of optical signals. Whereas a light emitting module (LED for optical communications) 21c and a light receiving module (photo acceptance element) 21d are provided in pairs to the main body 10a  
15           and the battery pack 10b, respectively, in order to send the data from the main body 10a to the battery pack 10b in the form of optical signals.

          Such a type of optical communications module 21 used as the interface section would eliminate the  
20           protrusion of a terminal, such as an connector, from the main body 10a or the battery pack 10b toward the outside.

          As it suffices that the data from the user verifying section 100 is sent from the battery pack 10b to the  
25           main body 10a, the optical communications module 21 needs to have at least the light emitting module 21a and the light receiving module 21b.



(4-2) First Modification of Fourth Embodiment:

FIG. 9 shows a first modification of the mobile electronic apparatus (first modification of the interface section) of the fourth embodiment. The mobile electronic apparatus 10D-1 of FIG. 9 has radio communications sections 22a, 22b to serve as the interface section. The radio communications sections 22a, 22b are provided to the battery pack 10b and the main body 10a, respectively, to transfer the data (data output from the user verifying section 100 in the present embodiment) in the form of radio signals between the battery pack 10b and the main body 10a. Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted here.

Since the radio communications sections 22a, 22b serves as the interface section, thereby eliminating the need for any special construction for realizing the interface section, it is unnecessary to make any modification to the shape of the casing of the main body 10a and the battery pack 10b.

(4-3) Second Modification of Fourth Embodiment:

FIG. 10 shows a second modification of the mobile electronic apparatus (second modification of the interface section) of the fourth embodiment. The mobile electronic apparatus 10D-2 of FIG. 10 has an electric contact (connector) 23 to serve as the

interface section. The electric contact 23 is connected between the battery pack 10b and the main body 10a to transfer the data (data from the user verifying section 100 in the present embodiment) therebetween.

5 Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted here.

(4-4) Third Modification of Fourth embodiment:

FIG. 11 shows a third modification of the mobile  
10 electronic apparatus (third modification of the interface section) of the fourth embodiment. The mobile electronic apparatus 10D-3 of FIG. 11, like the mobile electronic apparatus 10C of the third embodiment, has the signal synthesizing circuit 40, the signal  
15 separating circuit 50, the data converting section 60, and the keyboard signal input section 70 in place of the data communications sections 11, 12 and the interface section 20 of FIG. 6. In other words, the mobile electronic apparatus 10D-3 of FIG. 11 is equipped  
20 with the user verifying section 100 in place of the extended keyboard section 32 of the mobile electronic apparatus 10C of FIGS. 3 through 5. Like reference numbers designate similar parts or elements throughout several views, so their detailed description is omitted  
25 here.

With this construction of the mobile electronic apparatus 10D-3, the data output from the user verifying

section 100 is sent from the battery pack 10b to the main body 10a via the power supply terminal 13, which is electrically connected between the battery pack 10b and the main body 10a for supplying electric power from the battery 10c to the main body 10a.

Precisely, the data output from the user verifying section 100 is carried onto an output voltage of the battery 10c by the signal synthesizing circuit 40 in the form of an FM modulation signal or an AM modulation signal to make a synthesized signal, which is sent to the main body 10a via the power supply terminal 13. On the main body 10a side, the synthesized signal received from the battery pack 10b is separated into a power supply component and a data signal component by the signal separating circuit 50.

The data signal thus separated from the synthesized signal is converted by the data converting section 60 into a key-input-pattern signal (keyboard signal) of a predetermined form and then input to the keyboard signal input section 70.

Hereby, since it is possible to keep the compatibility between the data output from the user verifying section 100 and the input data signal, such as passwords, input through the keys (push/press buttons) of the main body 10a, the data output from the user verifying section 100 can be input to the keyboard signal input section 70 without discriminated from the

above-mentioned keyboard signal input through the keys.

(4-5) Other Modification of Interface:

A cable (not shown) connecting the user verifying section 100 (data communications section 11) and the connector terminal (not shown) of the main body 10a may  
5 be used as another interface section.

(4-6) Fourth Modification of Fourth Embodiment:

FIG. 12 shows a fourth modification of the mobile electronic apparatus of the fourth embodiment. The  
10 mobile electronic apparatus 10D-4 of FIG. 12 is constructed the same as the mobile electronic apparatus 10D of FIG. 6 and additionally has an external interface section 80 built in the battery pack 10b as an integral part. Like reference numbers designate similar parts  
15 or elements throughout several views, so their detailed description is omitted here.

The external interface section 80 is connected with an information device 90, such as a mobile electronic information terminal and a personal computer,  
20 other than the main body 10a, to transfer data between the information device 90 and the user verifying section (input/output section, input section) 100. The data transferred therebetween is, for example, data output from the user verifying section 100 (fingerprint feature  
25 information for verification, verification result, and personal data) and the setting information of the user verifying section 100 (extended I/O device section 30,

etc.).

With this construction, it is possible to access from the information device 90 to the user verifying section 100 (extended I/O device section 30, etc.) via the external interface section 80 to make a change in the setting state of the user verifying section 100. Moreover, it is also possible to directly output to the information device 90, the data (signal from the extended I/O device section 30) output from the user verifying section 100, via the external interface section 80, thus further improving the user friendliness.

In this instance, the external interface section 80 may be equipped to the above-mentioned mobile electronic apparatus 10A through 10D, 10D-1 through 10D-3, and also to the mobile electronic apparatus 10D-5 described later.

#### (4-7) First Example of User Verifying Section:

Examples of such user verifying sections of the fourth embodiment will now be described with reference to FIGS. 13 through 17.

FIG. 13 shows a first example of the user verifying section of the fourth embodiment. The user verifying section 100A of FIG. 13 comprises an input section 110 and an extracting section 120, for verifying a user by using biometric information (fingerprint, palmprint, finger shape, hand shape, voiceprint, retina, iris,

facial recognition, signature dynamics, blood vessel pattern, key strokes, etc.). In the following description, a fingerprint is employed as exemplary biometric information.

5       The input section 110 measures and inputs fingerprint information (image data of a fingerprint) of an object person to be verified.

From the fingerprint information thus measured and input, the extracting section 120 extracts  
10   fingerprint feature information for verifying the object person. Here, the fingerprint feature information extracted from the fingerprint information (image data of the fingerprint) is the coordinates of such points as ridge dividing points (minutiae), ridge  
15   end points (minutiae), ridge crossing points, the fingerprint core, and deltas, and ridge directions, distances between minutiae, the number of ridges between minutiae, and so on.

The user verifying section 100A is equipped to  
20   the battery pack 10b, and the fingerprint feature information of the object person extracted by the extracting section 120 is sent from the battery pack 10b side to the main body 10a via the interface section 20 or the signal synthesizing circuit 40 so that the  
25   fingerprint feature information of the object person can be verified on the main body 10a side.

(4-8) Second Example of User Verifying Section:

FIG. 14 shows a second example to the user verifying section of the fourth embodiment. The user verifying section 100B of FIG. 14 further comprises a storage section 130 and a comparing/verifying section 140 in addition to the above-mentioned input section 110 and extracting section 120.

The storage section 130 stores previously obtained reference fingerprint feature information of the authorized user of the mobile electronic apparatus.

10 The comparing/verifying section 140 compares/verifies the fingerprint feature information of the object person, which is extracted by the extracting section 120, with the reference fingerprint feature information stored in the storage section 130 to discriminate whether or not the fingerprint feature information to be verified satisfies a predetermined matching condition with respect to the reference fingerprint feature information. If the result of the discrimination is positive, the fingerprint feature information of the object person, which has been extracted by the extracting section 120, is judged matching the authorized user's. In this instance, the predetermined matching condition is such that the rate (degree) of matching between the biometric feature information to be verified and the reference biometric feature information is larger than a predetermined value.

The user verifying section 100B is equipped to the battery pack 10b, and the result of the verification performed by the comparing/verifying section 140 is sent from the battery pack 10b side to the main body 10a via the interface section 20 or the signal synthesizing section 40 so that, in reply to the result of the fingerprint verification, corresponding processes can be performed on the main body 10a side.

(4-8-1) First Modification to Second Example of User Verifying Section:

FIG. 15 shows a first modification to the second example of the user verifying section of the fourth embodiment. In the user verifying section 100B-1 of FIG. 15, previously obtained reference fingerprint feature information is stored or registered in a portable memory medium, or an IC card 131. For this purpose, an IC card interface section 132 and a feature information read-out section 133 are provided in place of the storage section 130.

The IC card interface section (medium interface section) 132 is connected with the IC card (portable memory medium) 131 in which the previously obtained reference fingerprint feature information has been registered or stored. The feature information read-out section 133 reads out from the IC card 131 the reference fingerprint feature information via the IC card interface section 132 to send the readout information



to the comparing/verifying section 140.

With this construction, the user verifying section 100B-1 verifies whether or not the object person is the authorized user whose fingerprint feature information is registered in the IC card 131 as the reference fingerprint feature information.

At that time, as a portable memory medium, various types of memory media rather than the IC card may be used, being exemplified by a memory card, such as an optical card and a BioCard (commercially available with trade name), a Smart Media (trade name of Toshiba Corporation), and a Memory Stick (trade name of SONY Corporation).

(4-8-2) Second Modification to Second Example of User Verifying Section:

FIG. 16 shows a second modification to the second example of the user verifying section of the fourth embodiment. In the user verifying section 100B-2 of FIG. 16, the reference fingerprint feature information is received from the external apparatus by wireless. For this purpose, a feature information read-out section 133 and a communications section 134 are provided in place of the storage section 130.

The communications section 134 receives the reference fingerprint feature information from the external apparatus by wireless, which information is then readout by the feature information read-out section

133 for being output to the comparing/verifying section 140.

With this construction, the user verifying section 100B-2 verifies whether or not the object person is the authorized user whose fingerprint feature information is received via the communications section 134 from the external apparatus as the reference fingerprint feature information.

(4-9) Third Example of User Verifying Section:

FIG. 17 shows a third example of the user verifying section of the fourth embodiment. In the user verifying section 100C of FIG. 17 further comprises a storing section 150 and a personal data read-out section 160 in addition to the input section 110, the extracting section 120, the storage section 130, and the comparing/verifying section 140.

The storing section 150 stores previously obtained personal data of the authorized user of the mobile electronic apparatus such as, a PIC including a password, PIN, or a secret key; account information corresponding to the PIC, including an account name, an ID, a computer name, or an IP address (more specifically, a bank account number); and a system name corresponding to the account information (more specifically, a bank name, application name, computer name, etc.); the health insurance certificate number; and medical information.

As the result of comparison of the fingerprint

feature information of the object person and the reference fingerprint feature information, if the comparing/verifying section 140 recognizes the fingerprint feature information of the object person  
5 matching the reference fingerprint feature information, the personal data read-out section 160 readouts the personal data stored in the storing section 150.

The user verifying section 100C is equipped to the battery pack 10b, and the personal data, which is  
10 readout by the personal data read-out section 160, is sent from the battery pack 10b side to the main body 10a via the interface section 20 or the signal synthesizing circuit 40 so that the mobile electronic apparatus 10D, 10D-1 through 10D-5 are added with the  
15 function of managing the authorized user's personal data stored in the storing section 150 by fingerprint verification.

Therefore it is possible to protect and guard the personal data by verifying a user with fingerprint  
20 information (biometric information), which is free from being stolen or faked by an unauthorized user. For example, the user must be verified using a fingerprint before the personal data is sent to the main body 10a side, thus enabling an access to the personal data,  
25 thereby guaranteeing a highest degree of security.

As shown in FIGS. 15 and 16, also in the user verifying section 100C, the storage section 130 may be

substituted by the IC card interface section 132 and the feature information read-out section 133, or by the feature information read-out section 133 and the communications section 134, so that the reference  
5 biometric feature information (reference fingerprint feature information) is received from an external apparatus.

(4-10) Fifth Modification of Fourth Embodiment:

FIG. 18 shows a fifth modification of the mobile  
10 electronic apparatus of the fourth embodiment. The mobile electronic apparatus 10D-5 of FIG. 18 has the user verifying section 100C of FIG. 17 to serve as the user verifying section 100 of the mobile electronic apparatus 10D-3 of FIG. 11. Like reference numbers  
15 designate similar parts or elements throughout several views, so their detailed description is omitted here.

With this construction of the mobile electronic apparatus 10D-5, the personal data, which is readout by the personal data read-out section 160 of the user  
20 verifying section 100C, is sent from the battery pack 10b to the main body 10a via the power supply terminal (DC terminal) 13, which is electrically connected between the battery pack 10b and the main body 10a for supplying electric power from the battery 10c to the  
25 main body 10a.

Precisely, the personal data readout from the user verifying section 100C is carried onto an output voltage

of the battery 10c by the signal synthesizing circuit 40 as data signal in the form of an FM modulation signal or an AM modulation signal to produce a synthesized signal, which is then sent to the main body 10a via the power supply terminal 13. On the main body 10a side, the synthesized signal received from the battery pack 10b is separated into a power supply component and a data signal component by the signal separating circuit 50.

10       The thus separated data signal, or the personal data, is converted into a key-pattern signal (keyboard signal) having a predetermined form, by the data converting section 60 before being input to the keyboard signal input section 70.

15       Hereby, since it is possible to keep the compatibility between the personal data from the user verifying section 100C and the input data signal input through the keys (push/press buttons) of the main body 10a, the personal data, such as a password, from the user verifying section 100C can be input to the keyboard signal input section 70 without being discriminated from the above-mentioned keyboard signal input through the keys.

25       In this manner, the mobile electronic apparatus 10D-5 becomes operable to manage and preserve the authorized user's personal data stored in the storing section 150 by fingerprint verification. Namely, it

is possible to protect and guard the personal data by verifying a user with fingerprint information, which is free from being stolen or faked by an unauthorized user. For example, the user must be verified using  
5 fingerprint information before sending the personal data to the main body 10a, thereby an access to the personal data is permitted in the main body 10a, thus guaranteeing a highest degree of security.

Therefore, it is possible to associate the storing  
10 section 150, which is guarded by user verification with fingerprint information, with the mobile electronic apparatus 10D-5 in a simple manner, namely, only by replacing the existing battery pack, which is detachably attached, with another battery pack 10b to which the  
15 user verifying section 100C is equipped, without the risk of impairing the mobility of the mobile electronic apparatus 10D-5 and without making any modification to hardware of the main body 10a of the mobile electronic apparatus 10D-5, thereby providing significantly  
20 improved user friendliness.

At that time, since the personal data is carried onto a power supply voltage by the signal synthesizing circuit 40, and is then, on the main body 10a side, separated and picked up from the voltage by the signal  
25 separating circuit 50, the power supply terminal 13 of the battery pack 10b can serve as both a power supply and an interface at the same time, thus making it possible

to transmit the personal data from the battery pack 10b to the main body 10a side without making any change in the present construction. It is thus resultantly possible to add an additional function, or user  
5 verification, to the existing mobile electronic apparatus, without the need for an interface newly equipped in hardware, or without making any change in the design of the mobile electronic apparatus.

(5) Various Other Modifications:

10 The present invention should by no means be limited to the above-illustrated embodiments, and various changes or modifications may be suggested without departing from the gist of the invention.

In the above description of the fourth embodiment,  
15 fingerprints are used as an example of biometric information. Alternative types of biometric information may be used; for example, iris, retina, palmprint, hand shape, voiceprint, facial recognition, signature dynamics, blood vessel pattern, key strokes  
20 may be either individually or in any combination.

Further, as substitute for biometric information, a single-sign-on verification using a long password may be employed so that the long password can be used for verifying a user when the biometric information cannot  
25 be used for a reason.

And further, although the attachment part of the mobile electronic apparatus is a battery pack in the

above embodiments, the present invention should by no means limited to this.

1. A method of determining the relative humidity of a gas mixture, comprising the steps of: (a) measuring the total pressure of the gas mixture; (b) measuring the partial pressure of the gas mixture; (c) determining the relative humidity of the gas mixture from the total pressure and the partial pressure; and (d) displaying the relative humidity of the gas mixture.